FINAL

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

Southwest DISTRICT • Tampa Bay BASIN

TMDL Report

Fecal and Total Coliform TMDL for Sparkman Branch

(WBID 1561)

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2000 305(b) Report

http://www.dep.state.fl.us/water/305b/index.htm

Criteria for Surface Water Quality Classifications

http://www/dep.state.fl.us/legal/legaldocuments/rules/ruleslistnum.htm

Basin Status Report for the Hillsborough Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report for the Hillsborough Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Allocation Technical Advisory Committee (ATAC) Report

http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf

U.S. Environmental Protection Agency, National STORET Program

http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal and total coliform for Sparkman Branch in the Hillsborough River Basin. The stream was verified as impaired for fecal and total coliform, and was included on the Verified List of impaired waters for the Hillsborough Basin that was adopted by Secretarial Order in May of 2004. The TMDL establishes the allowable loadings to Sparkman Branch that would restore the waterbody so that it meets its applicable water quality criteria for fecal and total coliform.

1.2 Identification of Waterbody

Sparkman Branch is a first order stream located in the north central area of Hillsborough County (Figure 1.1). It flows in a southeast-to-northwest direction into Pemberton Creek and drains a watershed area of about 27.4-square-miles (mi^2)**.** The stream is about two miles long and is flanked by State Route 400 to the north and State Route 39 to the west. The nearest major urban center to Sparkman Branch is Plant City, approximately one mile to the east.

The watershed is part of the Gulf Coastal Lowland area, which has a relatively low relief and abundant existence of Karst features. Interaction of surface water with the ground water is frequent in this area. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Group 1 Tampa Bay Basin (Florida Department of Environmental Protection [FDEP], 2001).

For assessment purposes, the Department has divided the Hillsborough River Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach and Sparkman Branch has been assigned WBID 1561..

1.3 Background

This report was developed as part of the Florida Department of Environmental Protection's (Department) watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's fifty-two river basins over a five-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA, Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. TMDLs provide important water quality restoration goals that will guide restoration activities.

Figure 1.1. Hillsborough River Basin

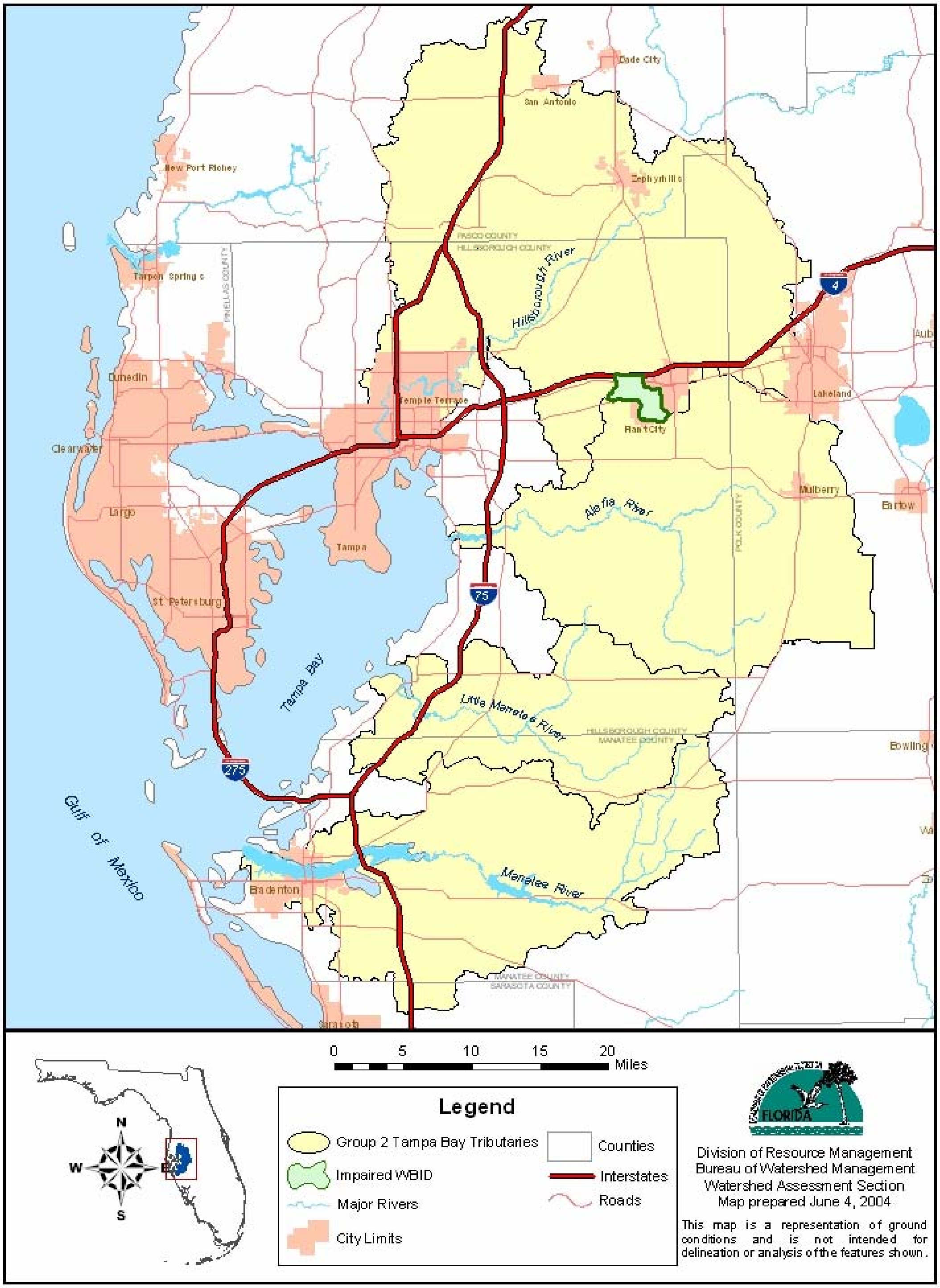
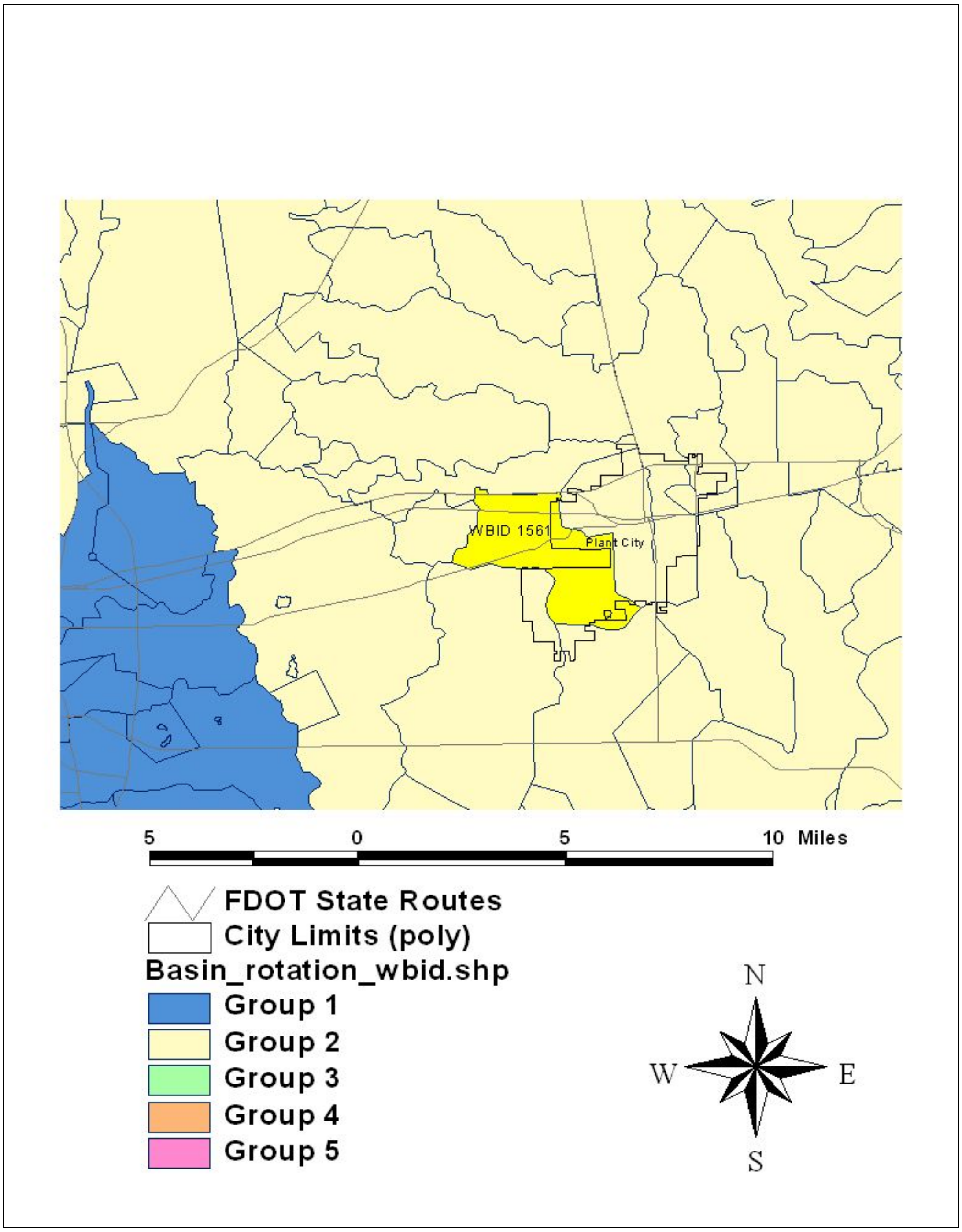


Figure 1.2. Location of Sparkman Branch in the Hillsboro River Basin



This TMDL Report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal and total coliform that caused the verified impairment of Sparkman Branch. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD) Water Management District, local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the EPA a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the identified impairment of the listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4)] Florida Statutes [F.S.]),and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 21 waterbodies in the Hillsborough River Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Sparkman Branch watershed and verified that the stream was impaired for fecal and total coliform bacteria (**Table 2.1)**. The impairment verification was based on the observation that 6 out of 20 fecal coliform samples collected during the verified period (January 1, 1996 – June 30, 2003) exceeded the fecal coliform criterion, and 5 out of 16 total coliform samples exceeded the total coliform criterion. The exceedances ranged from 430 MPN/100 ml to 4,300 MPN/100 ml for fecal coliform, and from 2,600 MPN/100 ml to 6,300 MPN/100 ml for total coliform. This TMDL represents a determination of the assimilative capacity of Sparkman Branch for both fecal and total coliform. Monitoring results of fecal coliform for the verified period are provided in Table 2.2, and monitoring results of total coliform for the verified period are provided in Table 2.3.

Table 2.1. Verified Impaired Segments in Sparkman Branch

WBID	Waterbody Segment	Parameters of Concern	Priority for TMDL Development	Projected Year for TMDL Development
1561	SPARKMAN BRANCH	Fecal Coliform	HIGH	2003*
1561	SPARKMAN BRANCH	Total Coliform	HIGH	2003*

*These TMDLs were scheduled to be completed by December 31, 2003, based on a Consent Decree between EPA and EarthJustice, but the Consent Decree allows a 9-month extension for the completion of TMDLs.

Table 2.2. Summary of Fecal coliform monitoring Data

Units: MPN/100 ml

Station ID	Date	Time	Result
21FLSWFDFLO0061	12/1/92	1400	290
21FLSWFDFLO0061	3/15/93	1230	220
21FLSWFDFLO0061	6/8/93	1100	300
21FLSWFDFLO0061	8/23/93	1225	**3550**
21FLTPA 24030126	8/26/98	1115	268
21FLTPA 24030126	3/27/02	215	**880**
21FLTPA 28005778210285	3/27/02	150	**690**
21FLTPA 28005778210285	5/23/02	950	130
21FLTPA 24030126	5/30/02	1100	1
21FLTPA 28005778210285	5/30/02	1130	**4300**
21FLTPA 24030126	7/17/02	955	370
21FLTPA 28005778210285	7/17/02	1015	**430**
21FLTPA 24030126	8/6/02	1145	35
21FLTPA 28005778210285	8/6/02	1130	35
21FLTPA 24030126	9/16/02	1145	115
21FLTPA 28005778210285	9/16/02	1130	80
21FLTPA 24030126	10/14/02	1125	**1800**
21FLTPA 28005778210285	10/14/02	1100	290
21FLTPA 24030126	11/4/02	1120	40
21FLTPA 28005778210285	11/4/02	1100	1

Note: Bold numbers represent the measurements that exceeded the water quality criteria.

Table 2.3. Summary of Total coliform monitoring Data

Units: MPN/100 ml

Station ID	Date	Time	Result
21FLTPA 24030126	9/16/02	1145	1140
21FLTPA 24030126	11/4/02	1120	700
21FLTPA 24030126	5/30/02	1100	**6300**
21FLTPA 24030126	8/6/02	1145	1000
21FLTPA 24030126	7/17/02	955	1240
21FLTPA 24030126	3/27/02	215	2000
21FLTPA 24030126	8/26/98	1115	320
21FLTPA 24030126	10/14/02	1125	**3100**
21FLTPA 28005778210285	5/23/02	950	530
21FLTPA 28005778210285	9/16/02	1130	1020
21FLTPA 28005778210285	5/30/02	1130	**5300**
21FLTPA 28005778210285	3/27/02	150	**2600**
21FLTPA 28005778210285	7/17/02	1015	**3300**
21FLTPA 28005778210285	10/14/02	1100	1040
21FLTPA 28005778210285	8/6/02	1130	520
21FLTPA 28005778210285	11/4/02	1100	400

Note: Bold numbers represent the measurements that exceeded the water quality criteria.

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

Sparkman Branch is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairment addressed by this TMDL are fecal and total coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria and total coliform bacteria concentrations. The water quality criteria for protection of Class III waters, as established by Chapter 62-302, F.A.C., states the following:

> ***Fecal Coliform Bacteria:***
> *The most probable number (MPN) or membrane filter (MF) counts per 100 ml of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*
>
> ***Total Coliform Bacteria:***
> *The MPN per 100 ml shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month; and less than or equal to 2,400 at any time.*

For both parameters, the criteria state that monthly averages shall be expressed as geometric means based on a minimum of ten samples taken over a thirty-day period. During the development of load curves for the impaired streams (as described in subsequent sections), there were insufficient data (less than 10 samples in a given month) available to evaluate the geometric mean criterion for either fecal coliform or total coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 for fecal coliform, or 2400 for total coliform, as single sample maximums.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern to the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination Program (NPDES). These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see Section 6.1). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of fecal and total coliform in the Sparkman Branch Watershed

4.2.1 Point Sources

There are no NPDES permitted wastewater treatment facilities that discharge either directly or indirectly into Sparkman Branch.

Municipal Separate Storm Sewer System Permittees

Within the Tampa Bay Basin, the stormwater collection systems owned and operated by Plant City, Hillsborough County, and the Florida Department of Transportation for Hillsborough County are covered by an NPDES municipal separate storm sewer system (MS4) permit, FLS000006. Hillsborough County is the lead co-permittee for the Sparkman Branch watershed. In October 2000, Hillsborough County drafted a watershed management plan involving berm construction, channel improvements, and structural upgrades for flood control and some water quality treatment. Other recommendations for the Sparkman Branch watershed included beginning a study to identify areas or sources that discharge pathogens, and beginning to provide treatment through the implementation of best management practices (BMPs) to reduce the loadings. The Hillsborough Planning and Growth Management Department is in the process of carrying out a septic tank study for the watershed that identifies the location of septic tanks, assesses their impacts on water quality, and recommends management techniques to improve their efficiency.

4.2.2 Land Uses and Nonpoint Sources

Because no major point sources were identified in the Sparkman Branch watershed, the primary loadings of fecal coliform to Sparkman Branch are generated from nonpoint sources in the basin. Nonpoint sources of coliform bacteria generally, but not always, involve accumulation of coliform bacteria on land surfaces and wash off as a result of storm events, and contribution from ground water caused by sources such as failed septic tanks and improper land application of domestic wastewater residual. Typical nonpoint sources of coliform bacteria include:

- Wildlife
- Agricultural animals
- Pets in residential area
- Onsite Sewer Treatment and Disposal Systems (septic tanks)
- Land application of domestic wastewater residual
- Urban development (outside of Phase I or II MS4 discharges)
- Leaking sewer lines

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 land use coverage (scale 1:40,000) contained in the Department's GIS library. Land use categories in the watershed were aggregated using the Level 1 codes tabulated in **Table 4.1. Figure 4.1** shows the acreage of the principal land uses in the watershed.

The dominant land use category is urban open land. The total area occupied by the residential land use categories is about 1,397.2 acres and accounts for about 28% of the total watershed area. Another 17% of the watershed is claimed by agriculture and rangeland. The natural landuse area, which includes upland forest, water, and wetland, accounts for about 25% of the total watershed area. Table 4.1 lists the area for each land use category. A general impression is that the watershed is rural and medium density residential, which is most likely to have septic tank systems. Leakage from these systems could be a potential source of fecal and total coliform. Contribution from the livestock in the open land areas used as pasture or rangeland could be another important source of fecal and total coliform. In addition, wildlife contribution in some of the open land and swamp areas could also contribute to the high fecal and total coliform concentrations in Sparkman Branch.

Table 4.1. Classification of Land Use Categories in the Sparkman Branch Watershed

Level 1	Land Use Attribute	Area (Square Meters)	Area (Acres))	Area (Square Miles)	Percentage
1000	Urban Open	4904691.45	1211.5	1.8923	24.61
1100	Residential Low Density < 2 Dwelling Units	1004634.42	248.1	0.3876	5.04
1200	Residential Med Density 2->5 Dwelling Unit	3247221.01	802.1	1.2528	16.30
1300	Residential High Density	1404697.55	347.0	0.5420	7.05
2000	Agriculture	3282046.78	810.7	1.2663	16.47
3000	Rangeland	21472.48	5.3	0.0083	0.11
4000	Forest/rural open	1067780.73	263.7	0.4120	5.36
5000	Water	652257.73	161.1	0.2517	3.27
6000	Wetlands	3272622.40	808.3	1.2626	16.42
7000	Disturbed Land	263206.92	65.0	0.1015	1.32
8000	Transportation, Communication, and utilities	805493.45	199.0	0.3108	4.04
	TOTAL	19926124.91	4921.8	7.6878	100.00

Population

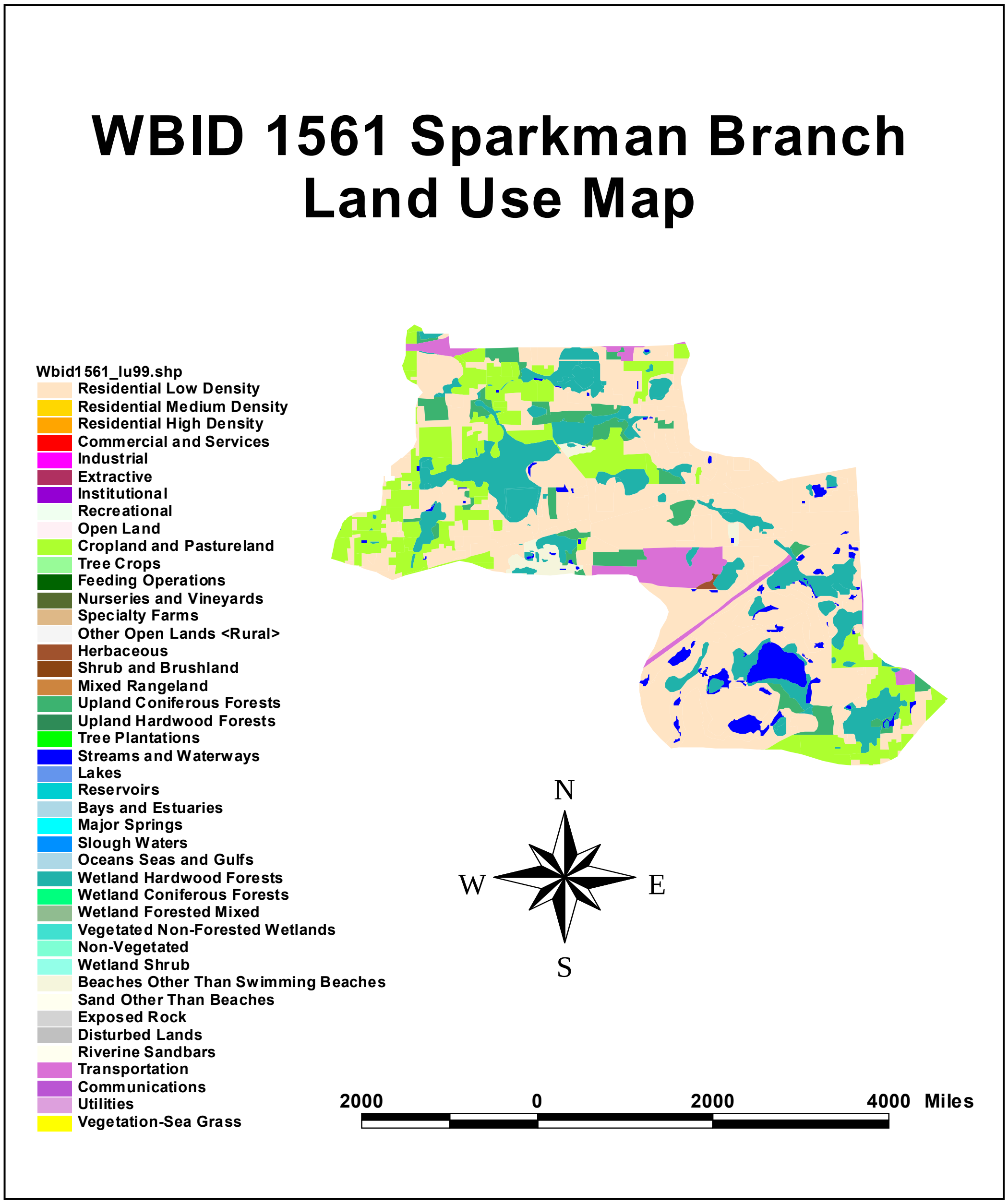
According to the U.S Census Bureau, the population density in and around WBID 1522C in the year 2000 was at or less than 405 people per square mile. The Bureau reports that the total population in Hillsborough County, which includes (but is not exclusive to) WBID 1522C, for 2000 was 998,948 with 425,962 housing units. This places Hillsborough County among the highest in housing densities in Florida (U.S. Census Bureau Web site, 2004). However, most of the high housing density is located further west of WBID 1561 in the Tampa Bay and Saint Petersburg areas. WBID 1561 is primarily composed of medium density residential (16.8%), and only 28.39 percent of the total land use in WBID is dedicated to residences.

Septic Tanks

The following information was obtained from the state of Florida Department of Health website: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm. Data for septic tanks is based on the 1970-2001 census results, with year by year additions based on new septic tank construction. The data does not reflect septic tanks that have been removed.

Hillsborough County has a cumulative registry of 100,483 septic tanks. With 425,962 households in the county, this means that approximately 76 percent of the residences within the county are connected to wastewater treatment plants, with the rest (24 percent) utilizing septic tanks. While the percent of residences with septic tanks within the Sparkman Branch watershed cannot be determined by these county-wide statistics, it is assumed that the percent of residences with septic tanks is higher for the Sparkman Branch watershed than the percentage for Hillsborough County given the rural nature of the watershed.

Figure 4.1. Principal Land Uses in the Sparkman Branch Watershed



Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Methodology Used to Determine Loading Capacity

The methodology used for this TMDL is the "load duration curve." Also known as the "Kansas Approach", because it was developed by the state of Kansas, this method has been well documented in the literature, with improved modifications used by EPA Region IV. Basically, the method relates the pollutant concentration to the flow of the stream to establish the existing loading and the allowable pollutant load (TMDL) under a spectrum of flow conditions. It then determines the maximum allowable pollutant load and load reduction requirement based on the analysis of the critical flow conditions. Using this method, it takes four steps to develop the TMDL and establish the required load reduction:

1. Develop the flow duration curve
2. Develop the load duration curve for both the allowable load and existing loading
3. Define the critical conditions
4. Establish the needed load reduction by comparing the existing loading to the allowable load under critical conditions.

5.2 Data Used in the Determination of the Loading Capacity

There are three sampling stations in WBID 1561 that have historical observations **(Figure 5.1).** The Department is the primary collector of historical data for the branch. The Department sporadically sampled two sites in the branch, commonly referred to as TP107-Sparkman Branch (STORET ID: 21FLTPA24030126), and SMB-3 Sparkman Branch (STORET ID 21FLTPA28005778210285). The sites were sampled eight times each from 12/1/92 through 11/4/02. **Figure 5.1** shows the locations of these sites, and **Table 5.1** provides a brief statistical overview of the observed data. **Tables 5.2** and **5.3** show all of the data collected from these sites and used in the development of this TMDL.

Figure 5.1 STORET Sampling Locations

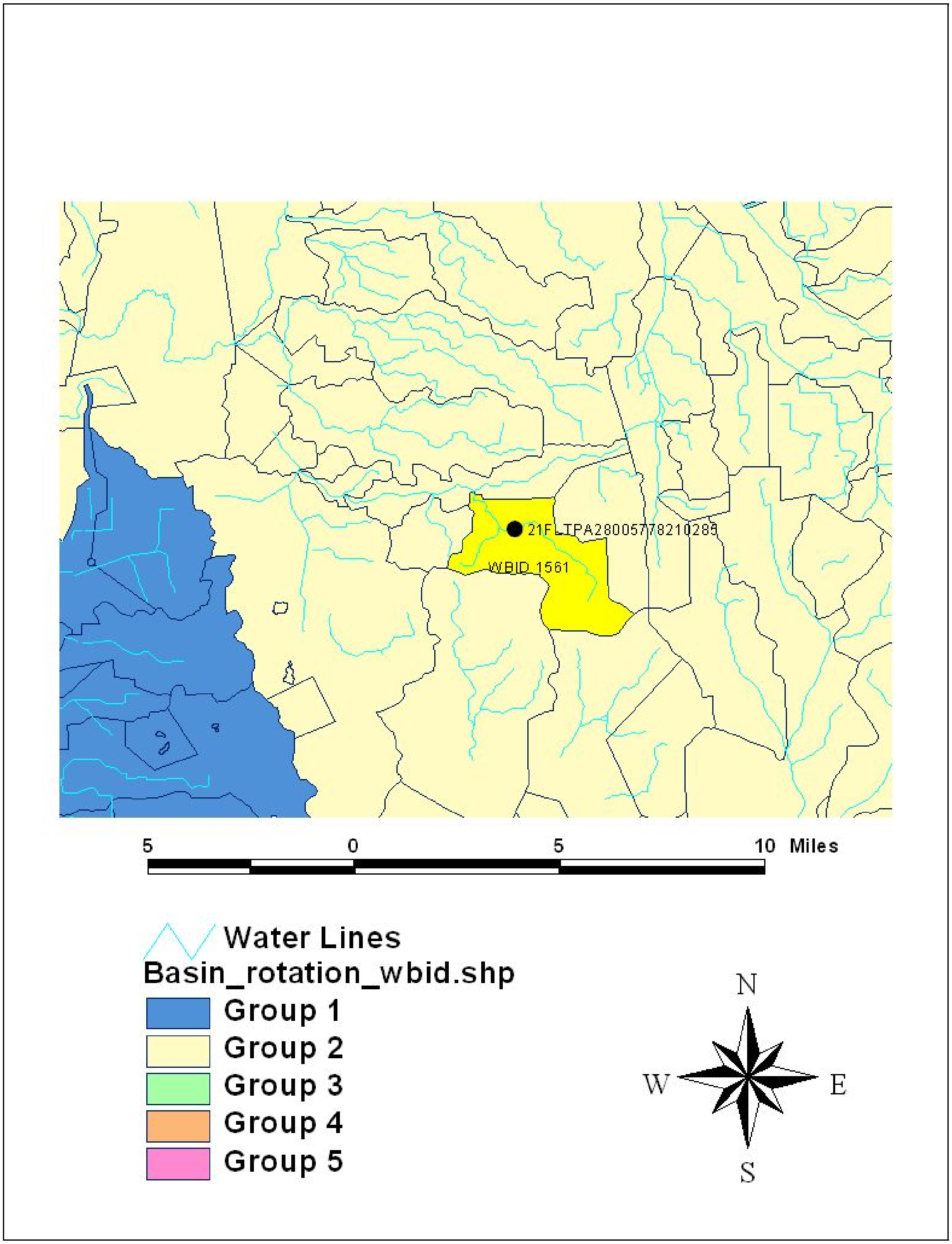


Table 5.1. Statistical Summary of Historical Data for Sparkman Branch

Storet Station ID	Parameter	Total Number of Observations	Minimum Concentration Counts	Maximum Concentration Counts	Number of Exceedences
21FLTPA24030126	Fecal Coliform	8	1	880	2
	Total Coliform	8	320	6,300	2
21FLTPA28005778210285	Fecal Coliform	8	1	4,300	3
	Total Coliform	8	400	5,300	3
21FLSWFDFL00061	Fecal Coliform	4	220	3,550	1

Table 5.2 Observed Fecal Coliform Data and Load Duration Calculation for WBID1561

Fecal Coliform Station	Sample Date	Sample Time	Flow (cfs)	Flow Rank	Flow Rank (%)	Fecal Coliform (CFU/100mL)	Fecal Coliform Load (CFU/day)
21FLSWFDFLO0061	12/1/92	1400	0.164	38.4%	38.4	290	1.16E+09
21FLSWFDFLO0061	3/15/93	1230	0.338	15.8%	15.8	220	1.82E+09
21FLSWFDFLO0061	6/8/93	1100	0.041	75.3%	75.3	300	3.01E+08
21FLSWFDFLO0061	8/23/93	1225	0.058	68.6%	68.6	3550	5.08E+09
21FLTPA 24030126	8/26/98	1115	0.195	32.5%	32.5	268	1.28E+09
21FLTPA 24030126	3/27/02	215	0.012	85.9%	85.9	880	2.65E+08
21FLTPA 28005778210285	3/27/02	150	0.012	85.9%	85.9	690	2.08E+08
21FLTPA 28005778210285	5/23/02	950	0.005	89.4%	89.4	130	1.53E+07
21FLTPA 24030126	5/30/02	1100	0.005	89.5%	89.5	1	1.15E+05
21FLTPA 28005778210285	5/30/02	1130	0.005	89.5%	89.5	4300	4.96E+08
21FLTPA 24030126	7/17/02	955	0.164	38.4%	38.4	370	1.49E+09
21FLTPA 28005778210285	7/17/02	1015	0.164	38.4%	38.4	430	1.73E+09
21FLTPA 24030126	8/6/02	1145	0.164	38.4%	38.4	35	1.41E+08
21FLTPA 28005778210285	8/6/02	1130	0.164	38.4%	38.4	35	1.41E+08
21FLTPA 24030126	9/16/02	1145	0.236	25.8%	25.8	115	6.64E+08
21FLTPA 28005778210285	9/16/02	1130	0.236	25.8%	25.8	80	4.62E+08
21FLTPA 24030126	10/14/02	1125	0.093	55.1%	55.1	1800	4.11E+09
21FLTPA 28005778210285	10/14/02	1100	0.093	55.1%	55.1	290	6.62E+08
21FLTPA 24030126	11/4/02	1120	0.103	52.2%	52.2	40	1.00E+08
21FLTPA 28005778210285	11/4/02	1100	0.103	52.2%	52.2	1	2.51E+06

Table 5.3 Observed Total Coliform Data and Load Duration Calculation for WBID1561

Total Coliform Station	Sample Date	Sample Time	Flow (cfs)	Flow Rank	Flow Rank (%)	Total Coliform (CFU/100mL)	Total Coliform Load (CFU/day)
21FLTPA 24030126	9/16/02	1145	0.236	25.8%	25.8	1140	6.58E+09
21FLTPA 24030126	11/4/02	1120	0.103	52.2%	52.2	700	1.76E+09
21FLTPA 24030126	5/30/02	1100	0.005	89.5%	89.5	6300	7.27E+08
21FLTPA 24030126	8/6/02	1145	0.164	38.4%	38.4	1000	4.01E+09
21FLTPA 24030126	7/17/02	955	0.164	38.4%	38.4	1240	4.98E+09
21FLTPA 24030126	3/27/02	215	0.012	85.9%	85.9	2000	6.02E+08
21FLTPA 24030126	8/26/98	1115	0.195	32.5%	32.5	320	1.53E+09
21FLTPA 24030126	10/14/02	1125	0.093	55.1%	55.1	3100	7.08E+09
21FLTPA 28005778210285	5/23/02	950	0.005	89.4%	89.4	530	6.25E+07
21FLTPA 28005778210285	9/16/02	1130	0.236	25.8%	25.8	1020	5.89E+09
21FLTPA 28005778210285	5/30/02	1130	0.005	89.5%	89.5	5300	6.12E+08
21FLTPA 28005778210285	3/27/02	150	0.012	85.9%	85.9	2600	7.83E+08
21FLTPA 28005778210285	7/17/02	1015	0.164	38.4%	38.4	3300	1.32E+10
21FLTPA 28005778210285	10/14/02	1100	0.093	55.1%	55.1	1040	2.37E+09
21FLTPA 28005778210285	8/6/02	1130	0.164	38.4%	38.4	520	2.09E+09
21FLTPA 28005778210285	11/4/02	1100	0.103	52.2%	52.2	400	1.00E+09

5.3 Determination of Required Percent Reduction

Develop the Flow Duration Curve

The first step in the development of load duration curves is to create flow duration curves. A flow duration curve displays the cumulative frequency distribution of daily flow data over the period of record. The duration curve relates flow values measured at a monitoring station to the percent of time the flow values were equaled or exceeded. Flows are ranked from low, which are exceeded nearly 100 percent of the time, to high, which are exceeded less than 1 percent of the time.

Because there were no long-term flow records for Sparkman Branch, data from a nearby gaged stream, Baker Creek (Gage 02303205, located at Baker Creek at McIntosh Road), were used to determine the flow duration curve for the branch. The flow duration curve was estimated using basin ratios for the two streams [the area of Sparkman Branch divided by the area of Baker Creek [7.7 square miles / 27.4 square miles = 0.28)]. The detailed flow duration curve for Baker Creek is available in the Department TMDL study for Baker Creek (WBID1522C, Perlowski & Wu, 2004).

Develop the Load Duration Curves for Both the Allowable Load and Existing Loading

Flow duration curves are transformed into load duration curves by multiplying the flow values along the flow duration curve by the coliform concentration and the appropriate conversion factors. The final result of the load is typically expressed as counts per day. The following equations were used to calculate the allowable loads and the existing loading:

(1) Allowable load = (observed flow) x (conversion factor) x (state criteria)

(2) Existing loading = (observed flow) x (conversion factor) x (bacteria measurement)

On the load duration curve, allowable and existing loads are plotted against the flow duration ranking. The allowable load is based on the water quality numeric criterion and flow values from the flow duration curve, and the line drawn through the data points representing the allowable load is called the target line. The existing loads are based on the in-stream coliform concentrations measured during ambient monitoring and an estimate of flow in the stream at the time of sampling. As noted previously, because insufficient data were collected to evaluate the geometric mean, 400 counts/100 mL was used as the target criterion for fecal coliform and 2,400 counts/100 mL for total coliform in this TMDL.

Figures 5.2 and **5.3** show both the allowable load and the existing load over the flow duration ranking for fecal coliform and total coliform, respectively, in Sparkman Branch. The points of the existing loading that were higher than the allowable load at a given flow duration ranking were considered an exceedance of the criteria.

As shown in **Figures 5.2** and **5.3**, exceedances of the coliform criteria in Sparkman Branch appeared during mid-range-flow and dry-condition-flow regimes (40%-90% duration interval). In general, exceedances on the right side of the curve typically occur during low-flow events, which implies a contribution from either point sources or baseflow. In contrast, exceedances on the left side of the curve usually represent the potential sources accumulated on the land surface, which could result from the land application of biosolids, wildlife, livestock, and pets. Because there are no point sources of coliforms in the Sparkman Branch watershed, the exceedances under the low-flow condition imply a contribution from baseflow, which could result from leaking septic tanks or sewer lines, or the improper application of biosolids on the land surface.

Figure 5.2. Load Duration Curve for Fecal Coliform in WBID 1561

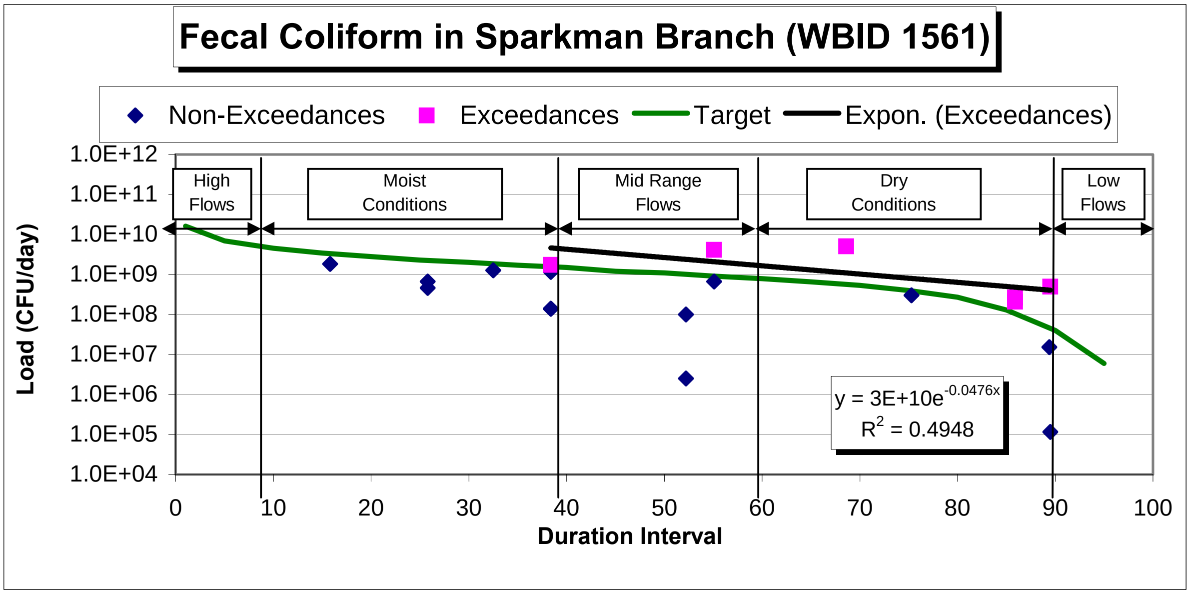
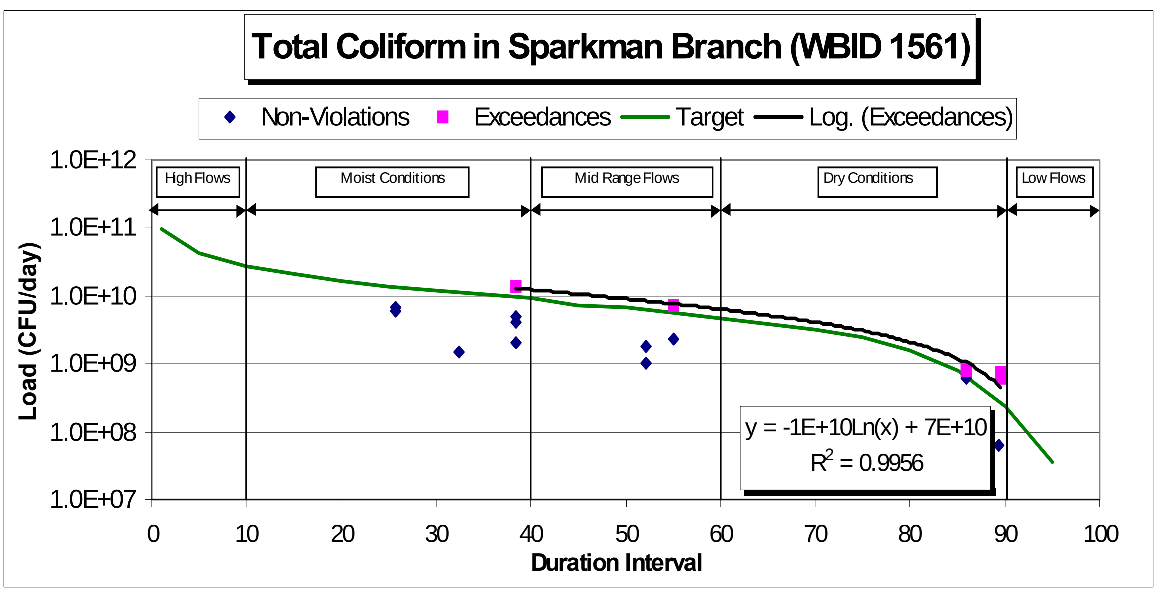


Figure 5.3. Load Duration Curve for Total Coliform in WBID 1561



Define the Critical Conditions

The critical condition for coliform loadings in a given watershed depends on the existence of point sources and land use patterns in the watershed. Typically, the critical condition for non-point sources is an extended dry period, followed by a rainfall runoff event. During wet weather periods, coliform bacteria built up on the land surface under dry weather conditions are washed off by rainfall, resulting in wet weather exceedances. However, significant nonpoint source contributions could also occur under dry weather conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer and coliform bacteria are brought into the receiving waters through baseflow. Livestock that have direct access to the receiving water could also contribute to the exceedances during dry weather conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

For the Sparkman Branch watershed, exceedances occurred during mid-range-flow and dry-condition-flow conditions. Because no major point source was identified in the watershed, exceedances appearing in all these intervals were considered to be from nonpoint sources. Critical conditions are accounted for in the load curve analysis by using the flow records and water quality data available between the 40th and 90th intervals.

Establish the Needed Load Reduction by Comparing the Existing Loading with the Allowable Load

Rather than calculate the needed percent reduction directly from measured values, the existing loading was estimated for specified flow intervals by regressing the measured exceedances versus flow (Regression Line Approach). The best-fitting trend line was determined by evaluating different functions until the highest R^2 value was found. In this case, the function determined to be the best fit ($R^2 = 0.4948$) for fecal coliforms took the following form:

y = 3E+10e-0.0476 x

The Regression Line Approach was also used to calculate the allowable load and percent reduction needed for total coliforms. The best-fitting trend line was again determined by evaluating different functions until the highest R_2 value was found. In this case, the function determined to be the best fit ($R^2 = 0.9956$) for total coliforms took the following form:

y = -1E+10Ln(x) + 7E+10

The existing loading of a given flow duration interval was calculated using the regression equation and a given flow duration interval between the 40th and 90th percentile, in 5 percentile increments. The allowable loading of a given flow duration interval was calculated using **Equation (1)**, within the flow duration interval with 5th percentile increments. The needed load reduction was then calculated using the following equation:

(3) $$\text{Load Reduction} = \frac{\text{Existing Loading} - \text{Allowable Loading}}{\text{Existing Loading}} \times 100\%$$

Using **Equation (3)**, the load reduction was determined for each flow interval. **Tables 5.4** and **5.5** list the flow duration intervals, allowable loadings, existing loadings, and needed load reductions for fecal coliform and total coliform, respectively.

Table 5.4 Table for Calculating Needed Reduction of Fecal Coliform

Flow Ranking %	Allowable Load for Fecal Coliform (counts/day)	Existing Load for Fecal Coliform (counts/day)	Percent Reduction Required
90	4.01E+07	4.14E+08	90.3
85	1.30E+08	5.25E+08	75.1
80	2.71E+08	6.66E+08	59.3
75	4.01E+08	8.45E+08	52.5
70	5.32E+08	1.07E+09	50.4
65	6.52E+08	1.36E+09	52.0
60	7.83E+08	1.72E+09	54.6
55	9.13E+08	2.19E+09	58.3
50	1.10E+09	2.78E+09	60.2
45	1.20E+09	3.52E+09	65.8
40	1.51E+09	4.47E+09	66.3

Table 5.5 Table for Calculating Needed Reduction of Total Coliform

Flow Ranking %	Allowable Load for Fecal Coliform (counts/day)	Existing Load for Fecal Coliform (counts/day)	Percent Reduction Required
90	2.41E+08	2.50E+10	99.0
85	7.83E+08	2.56E+10	96.9
80	1.63E+09	2.62E+10	93.8
75	2.41E+09	2.68E+10	91.0
70	3.19E+09	2.75E+10	88.4
65	3.91E+09	2.83E+10	86.1
60	4.70E+09	2.91E+10	83.8
55	5.48E+09	2.99E+10	81.7
50	6.62E+09	3.09E+10	78.5
45	7.23E+09	3.19E+10	77.4
40	9.03E+09	3.31E+10	72.7

The median of values between the 40th and 90th interval (range where exceedances occur) resulted in an allowable load for fecal coliform of 6.52E+08 cfu/day and a required percent reduction of 59.3 percent. Similarly, the median of values between the 40th and 90th interval (range where exceedances occur) resulted in an allowable load for total coliform of 3.91E+09 cfu/day, and a required percent reduction of 86.1 percent.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\textbf{TMDL} = \sum \textbf{WLAs} + \sum \textbf{LAs} + \textbf{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of BMPs.

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. TMDLs for the Sparkman Branch are expressed in terms of cfu/day and percent reduction, and represent the maximum annual fecal or total coliform load the river can assimilate and maintain the fecal or total coliform criterion **(Table 6.1).**

Table 6.1. TMDL Components for the Sparkman Branch

WBID	Parameter	TMDL (colonies/day)	Wastewater (colonies/day)	NPDES Stormwater	LA (Percent Reduction)†	MOS
1561	Fecal Coliform	6.52E+08 cfu/day	NA	59.3 %	59.3 %	Implicit
1561	Total Coliform	3.911E+09 cfu/day	NA	86.1 %	86.1 %	Implicit

† The percent reduction is based on 40th – 90th percentile of recurrence intervals, see Tables 5.1a and 5.1b

6.2 Load Allocation (LA)

Based on a loading duration curve approach similar to that developed by Kansas (Stiles, 2002), the load allocation for fecal coliforms is 6.52E+08 cfu/day and the median required reduction in fecal coliform loading from nonpoint sources is 59.3 percent. Similarly, the load allocation for total coliform is 3.91E+09 cfu/day, and the median required reduction in total coliform loading from nonpoint sources is 86.1 percent. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

There are no NPDES-permitted wastewater facilities that discharge coliform bacteria to surface waters in the Sparkman Branch watershed. Thus, the wasteload allocation for wastewater facilities is zero. Any future wastewater facility permitted to discharge coliform bacteria in the watershed will be required to meet permit limits and must not exceed the established TMDL values.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 59.3 percent reduction for fecal coliform and an 86.1 percent reduction for total coliform. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety (MOS)

Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with modeling assumptions and the development of assimilative capacity.

The percent reduction necessary to achieve water quality standards is based on the monitoring stations having the largest number of samples and the highest water quality exceedances. Due to dilution and decay, not all stations require the same reduction to meet standards. By selecting the highest required percent reduction, an implicit MOS is incorporated into the analysis. An additional MOS is included in the TMDL by not allowing any exceedances of state criteria, even though intermittent natural exceedances of the criteria would be expected and would be taken into account when determining impairment.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for the Hillsborough Basin. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- Appropriate allocations among the affected parties,
- A description of the load reduction activities to be undertaken,
- Timetables for project implementation and completion,
- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

References

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this study was conducted.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the fifteen counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

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